number of the failures to succeed must be attributed to the indiscriminate and thoughtless manner in which the treatment has been applied. Under the best management it is only too clear that a universally applicable panacea for this dread disease has not been discovered as yet, but certainly in radiotherapy there probably exists to-day a greater chance of cure in the average cases of cancer than in any other known procedure whether medical or surgical.

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TREATMENT OF CANCER BY THE X-RAY, WITH REMARKS ON THE USE OF RADIUM.

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As in the case of most innovations in medicine, so in the treatment of cancer by the X-ray, present opinion as to the possibility of curing this disease swings from over-credulity to scepticism, and so on, back and forth.

About the main fact that the X-radiation has already cured typical cases of every form of cancerous growth there is now no dispute. To one who watches such cases—that is to say, cases verified as cancerous by every known means of modern research—the result seems not alone marvelous but almost miraculous. The plain unvarnished fact is that some cases of cancer get absolutely well and that others do not. Undoubtedly there are a large number of instances of failure to cure, and it is these which furnish the fuel for unbelief, while equally the cured cases provide the basis of enthusiasm. The proposition as it now stands is to decide upon what cases and at what stages the X-ray may be used with confidence of success, and in what cases it may be fairly expected to be used with failure—in other words, to select cases appropriate for X-ray treatment.

It may be here put forward as a broad and general statement that the earlier the disease is discovered and the X-radiation employed, the more confident we may be of success, and for two reasons: First, because, as might be inferred from the word neoplasm, the young growth is cut down and restricted more easily than the more matured;

and, secondly, because the cancerous particles have not yet had time to migrate from their initial foci and spread the disease widely into districts which may be inaccessible to treatment. The corollary from this proposition is that every case of cancer should be treated by the X-ray at once and without delay and before surgical operation, and equally that every case after operation should be treated as soon as possible, which is practically within a few days, by the same means. It is generally admitted even now that all cases should be treated by the X-ray *after* operation to prevent a recurrence of the disease, and if used to prevent a recurrence, why should it not be used at the very first moment of the occurrence? Let us take a concrete example of carcinoma of the breast. It is well known that even in so short a time as from three to six weeks the carcinomatous particles may begin to be distributed and to localize themselves at new focal points, for instance, in the axillary glands and the lymphatics leading thereto. The time will not be far distant when they will extend beyond these glandular barriers. Time and again I have seen both lymphatics and glands, indurated, sensitive and evidently the seat of extending disease, recover their normal character and the initial carcinomatous focus in the breast disappear. This, too, in cases demonstrated to be carcinomatous by microscopical examination of a small portion of the tumor removed surgically. Such are the instances which afford the basis for enthusiasm. But take the same case six months later when cancerous distribution, though not evident, has become somewhat general, and the final outcome of the case may or will be a failure to cure, even if the initial tumor has been caused to disappear, for the metastatic foci are quite likely to

crop up in some remote quarter and kill the patient. In connection with this point of using the X-ray before an operation there is this important consideration, namely, the universally disastrous sequence of operative procedures. Every surgeon doubtless will admit that no matter how extensive his incisions and dissections may be carried out, the great danger arises from the severance of the lymphatic channels and the consequent distribution of infecting material, or from his failure to reach all the infected tissue. As a result a recurrence in at least three-quarters of the cases operated upon is inevitable, and the operation which appears on its face to be so radical and brilliant is merely a glossing over and a postponement of the evil day. To the X-radiation, on the contrary, no particular territory or lymphatic channel is more difficult to reach than any other, while at the same time no such channel is incised and its contents liberated to "soil" the wound. In such a case of primary mammary carcinoma, as above alluded to, at its early stage the X-ray practically arrests further spread of the out-going migration of the cancer particles, and for this reason alone, if for none of the others given, it should be used prior to operation.

And for this and many other reasons, it seems to me that either one or the other of the divergencies of the ways of operation or of X-radiation must be chosen at once and in the early stage of the disease, and equally that when in early cancer the disease has spread beyond the initial tumor, it is useless to temporize with operative procedures. In all early cases then, whether still restricted or whether already infecting lymphatics and glands of the axilla, I think the X-ray treatment far more likely, in the end, to be successful than the surgical operation.

But the situation becomes a different one when the cancer has become well advanced. The tumor is now of considerable size and the glands equally are enlarged. A great mass of tissue has become involved in the cancer proliferation, or indeed has begun to break down. In such instances I would also begin treatment with the X-ray in order to stop further progress of the disease, for, on the whole, it may be safely stated that the effect of the X-radiation is to produce a retrogression of the growth. But even though this is so, there still remains a vast mass of diseased tissue, which is, so to speak, merely a material superfluity, and which it is desirable to get rid of. In such a case there is every reason why a surgical operation should take place to excise tissue which is beyond the power of the X-ray to remove. It becomes simply a mechanical proposition to remove it by the knife. Such cases should be unhesitatingly referred to the surgeon for operation and then a continuance of the X-ray treatment be advised. Even so it is hardly likely that they will be cured, for when the disease has reached this stage, death, as a rule, results in from one to two years from metastases.

As to inoperable cancer, there can be no question but that the patient should be given every chance to recover, and there is to-day existent no chance better than that offered by the X-ray treatment.

In general some considerations bearing upon success or failure may be further pointed out.

1st. That the treatment should be begun early, and before the lymphatic system has become largely infected, has already been sufficiently dilated upon.

2d. The type of cancerous disease, as well as its stage, is an important consideration. The squamous-celled carcinomata or the rodent ulcer type may claim undoubtedly as high a percentage of cures as one hundred per cent. The accompanying illustration, Fig. 1 and 2, is but one of a great many of this type that I might produce which have been to date completely cured. This patient was treated three times weekly and received 42 treatments. As to the carcinomata of the breast, some, by reason of the nature of the growth, are remarkably slow in their progress, and some remarkably active. For instance, I have treated a patient who carried a tumor in the breast for five years, developed again at the end

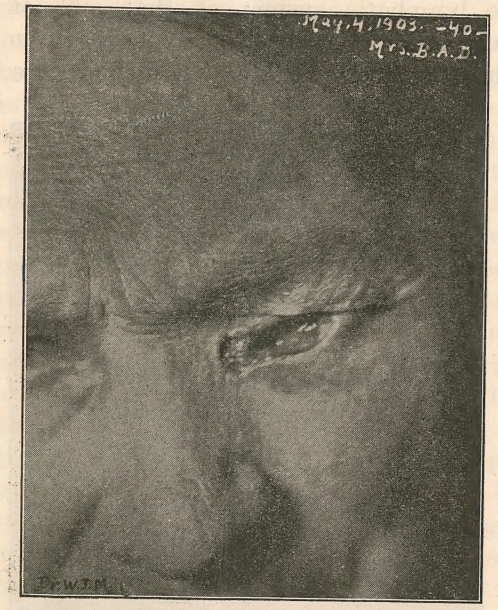

FIG. 1.

of another five years a tumor in the axilla, and at the end of another five years a tumor of about the same size above the clavicle. While, again, a case has presented itself with a single rapidly growing tumor of the breast, which quickly infected the entire lymphatic system of that side of the thorax and led to general systemic infection and death within two years. In the former case time

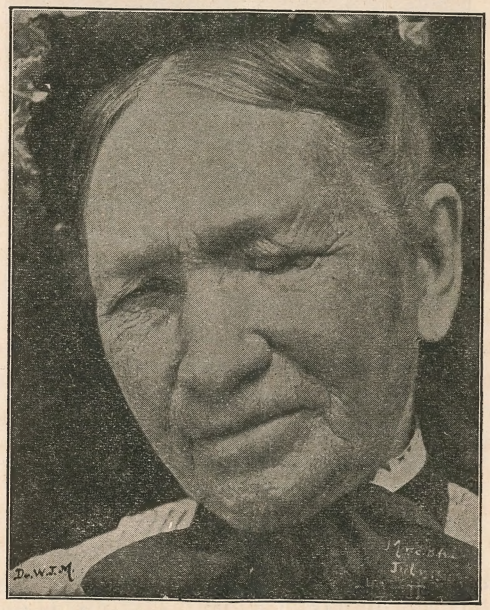

FIG. 2.

was allowed to the X-ray to accomplish good work. In the latter the rays failed to stem the tide and the patient was subsequently operated upon and soon died. These so-called "rapid" cases are frequently quite beyond the power of the X-ray to affect curatively.

3d. If the cancerous tumor has broken down

and become a large open ulcer, the chances of recovery are less than if the skin has remained unbroken. I have frequently treated cases on the point of breaking down where there has been an immediate retrogression of the tendency to break down and recovery has followed.

4th. When open ulcers exist, as I have already pointed out in prior communications, a danger of secondary septic infection may reside in the very treatment itself, for if the Crookes' tube, particularly when of high vacuum, be examined, it will be found to be coated on its outside with a dense layer of dust and dirt particles. These are the positive particles corresponding to a similar shower of negative particles which are projected into the ulcer and which may well lead to the secondary infection alluded to. For this reason I invariably cover the open ulcer during treatment with a layer of absorbent cotton.

5th. Probably in no respect will the good judgment of the operator be more severely tested than as to the intensity of the ray to employ in given cases. In carcinomata of the breast deeply-seated or other internal tumors, there is no doubt that the treatment may be carried up to the point where a very severe dermatitis of the overlying skin is produced, and this with the greatest advantage. On the other hand, in a superficial sarcoma or carcinoma directly beneath and involving the skin, there is a very great danger in producing a dermatitis, particularly a dermatitis of a severe and deep type, for there can be no doubt that the cancerous infiltration follows most rapidly into the tissues thus affected by the X-ray. In such cancers of the neck and side of the face there can be little doubt that the operator, to speak plainly and perhaps too roughly, may either kill or cure the

patient. If he gives a gentle X-ray three times weekly and just up to the point where the reddening of the skin is *not* produced, these tumors will often shrink and wither up, so to speak, and recede and disappear. Whereas, on the other hand, a severe X-ray will produce in a very brief time a rapid and great extension of the disease. In such cases no doubt the operator escapes blame and the fatal outcome is attributed to the disease itself, in my opinion quite wrongly.

6th. A new condition of affairs has been recently dwelt upon in the lay press which has served not a little to agitate the minds of patients who had intended to take X-ray treatment, and has deterred a great many from resorting to it. The statement, according to the newspapers, comes from Mr. Edison's X-ray laboratory to the effect that the system may become over-saturated with X-ray and thus be subject to a multitude of ills. That the X-ray is a powerful agency, so powerful indeed as to cause absolute necrosis and destruction of the skin, all admit. The same may be said of many of the useful drugs of the pharmacopeia. There are few of them but what may be used to kill or injure the patient, and yet their reasonable and proper employment is of the greatest benefit. It is scarcely fair to compare the intelligent use of the X-ray to the protracted experiments of exposure of the hands and arms of exhibitors before the fluoroscope. It may be safely said that the bugaboo of over-saturation by the X-ray does not exist in medicine.

Mode of Action. As to the mode of action of the X-ray, in the absence of positive knowledge it is practically useless to discuss the question. Any one of a number of theories may be advanced. It yet remains for investigators in physiological laboratories to reveal the facts. And when once decided what the X-ray does to living tissue, there still remains to decide how this affects the cancer growth. This later decision can never be reached until we know what cancer is, and we are yet utterly ignorant of its nature. The most reasonable theory as to its mode of action probably is that a mild leucocytosis is established with a consequent ability of the living tissue to cope with and conquer cancerous cell proliferation.

Technique. As to technique, the most important point is that the operator shall adopt some standard method of procedure, and shall not vary his methods from day to day, thus introducing an uncertainty into the interpretation of his subsequent results. Whether daily treatments of short duration or three or four times weekly treatment of longer duration are given, seems to me of little consequence. My practice has been to give treatments three times or four times weekly, of from fifteen to twenty minutes' duration, at a distance of nine inches with an X-ray radiation intensity affording a given picture of the lower end of the radius and ulna at two feet distance, thus producing a fair dermatitis in from two to four weeks and then continuing in the same manner. Following this plan I have never been surprised with an unexpected "burn" of great severity. These remarks apply to treatments upon one locality, but where, as is in Hodgkins disease and other general ailments, it is necessary to X-ray nearly the entire body, the patient may then be exposed to the rays at the distance named and the intensity referred to, daily for from three-quarters of an hour to an hour, without suffering harm, but, on the contrary, gaining in general health all the time.

As to shields, I believe that none should be em-

ployed except for the hair and the eyes, for one can never say how extensive a cancer infiltration has become, and the greater the area treated the greater the chances are of safety to the patient. I have known a local tumor of the breast to be treated through a hole in a lead shield for two months where the thoracic lymphatics and the axillary glands were continuously becoming diseased, while, at the same time, the local tumor was disappearing. The futility of the shield in such a case is only too obvious. The same remark applies to the local treatment of cancer of the uterus, where the general spread of the disease along the lymphatics of the broad ligament, in the glands and in the groin and neighboring regions has already occurred. Of what use to treat a local sore and leave the outlying infection which in its turn is certain to carry off the patient?

In the treatment of carcinomata of the breast it is important to treat the patient from behind and through the scapulæ as well as from the front. In fact, the thorax should be turned around and around before the X-ray tube. In short, in all cancerous tumors, it is important to cause the radiations to reach the tumor from many directions rather than from any one.

Artificial Fluorescence of Living Tissue. In an article in the *New York Medical Record* of August 8th, 1903, I described this new procedure. My plan was and is to saturate the patient's system with quinine or with some other solution capable of fluorescence under the influence of the X-ray and then to submit this patient to X-ray treatment. During a year or more I have pursued this plan with nearly all of my cases of cancer, and I have the strongest reasons to believe that this method has conduced very greatly to success. In

five cases of Hodgkins' disease, four of which I treated myself, while the fifth was treated by a physician after consultation with me, and in which I advised the use of quinine together with the X-ray in order to obtain this artificial fluorescence within the body, the fifth case, namely, the one in which the quinine was used, has made a most remarkable progress; every large gland has

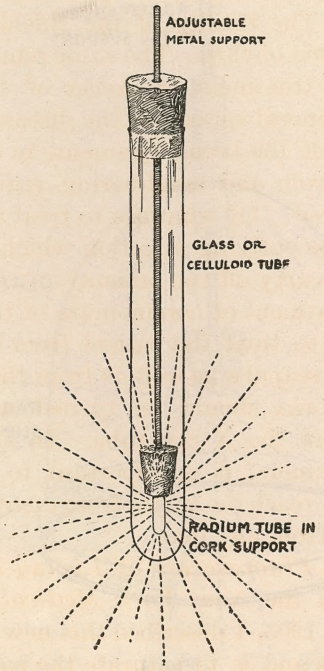

FIG. 3.

entirely disappeared and the patient is almost well. I administer from five to twenty grains of quinine one hour before treatment according to the tolerance of the patient for the drug.

Radium Treatment of Cancer. In general the radiations from radium may be said not to be

particularly dissimilar to the radiations generated within a Crookes' tube, and the curative effect upon cancer is undoubtedly similar. I am now using a salt of radium of three thousand and of seven thousand luminosity, respectively, and one great advantage which I find is that the radium salt, which, as is well known, is contained within

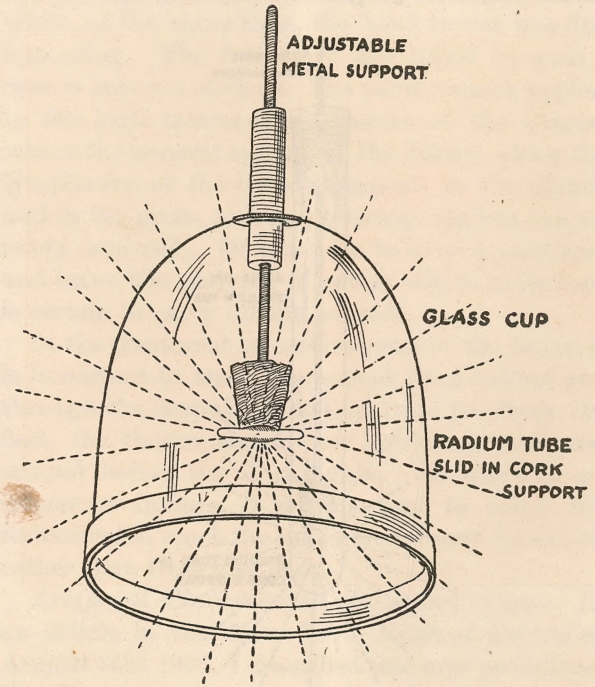

FIG. 4.

very small glass tubes, may with suitable contrivances be introduced within cavities, where it has been impossible heretofore to practically introduce the X-ray. This particularly applies to cancer of the throat treated from within and cancer of the uterus treated within the vaginal cavity. I have devised a special apparatus for these

treatments, which I here illustrate. (See Fig. 3.) In cancer of the uterus as well as within the throat cavities the radium salt thus proves to be a very great blessing. For the treatment of external cancer, I have devised a mechanical means of administration, which is illustrated in Fig. 4. Fig. 3 is a test tube or, preferably, a cellulose tube suitable for vaginal or throat introduction and within

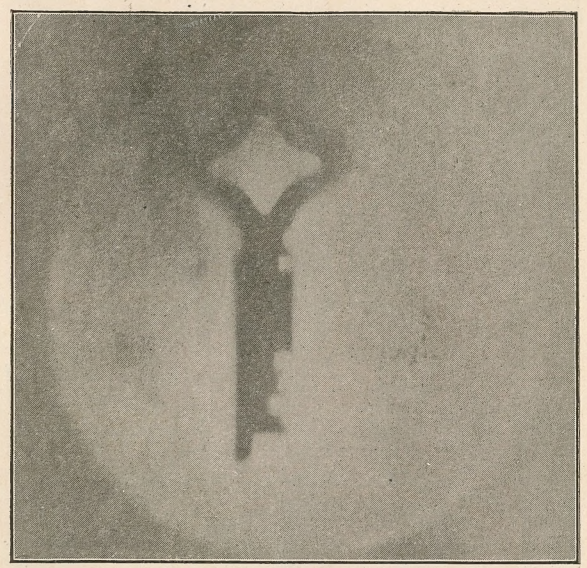

FIG. 5.

which the small radium tube is properly secured. Cellulose has the advantage over glass in that it does not materially obstruct the radiations. Fig. 4 is a glass bell-shaped cup within which the radium tube is secured by means of a wire capable of adjustment and suitable to be placed over the part to be treated. As illustrative of the power of radium and its similarity to the X-ray in affecting photographic plates and producing shadow pictures

corresponding to the density of the intervening object, I present illustrations 5, 6, 7 and 8, representing respectively a key, a cartridge, an ink eraser, and a silver heart and chain. While lack-

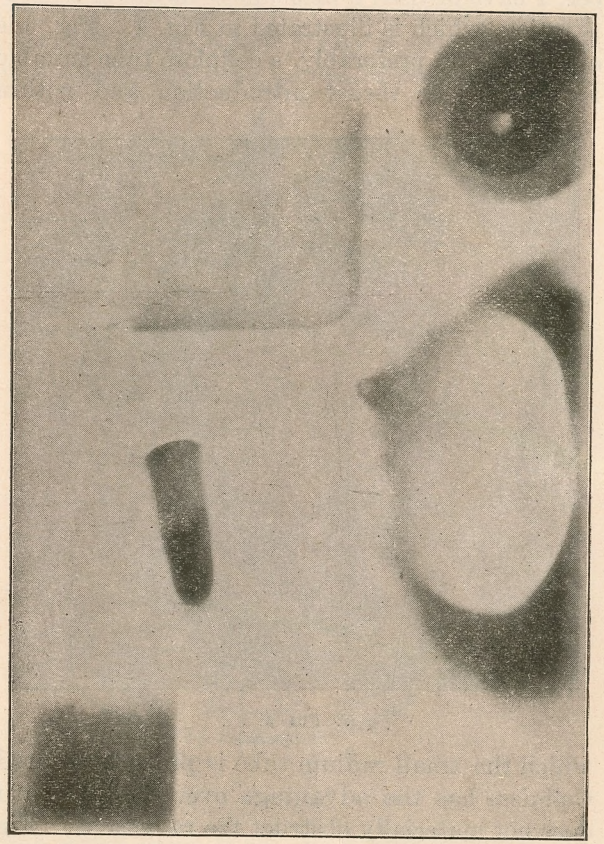

FIG. 6 and 7.

ing the definition of the X-ray picture, the radium pictures show a very powerful effect, and there is no doubt but that in the radium emission of negative particles we possess a most valuable addition to radiotherapy.

In concluding these brief observations no one can be more conscious than the writer of their shortcomings. The effort has been merely to briefly allude to practical points and to avoid

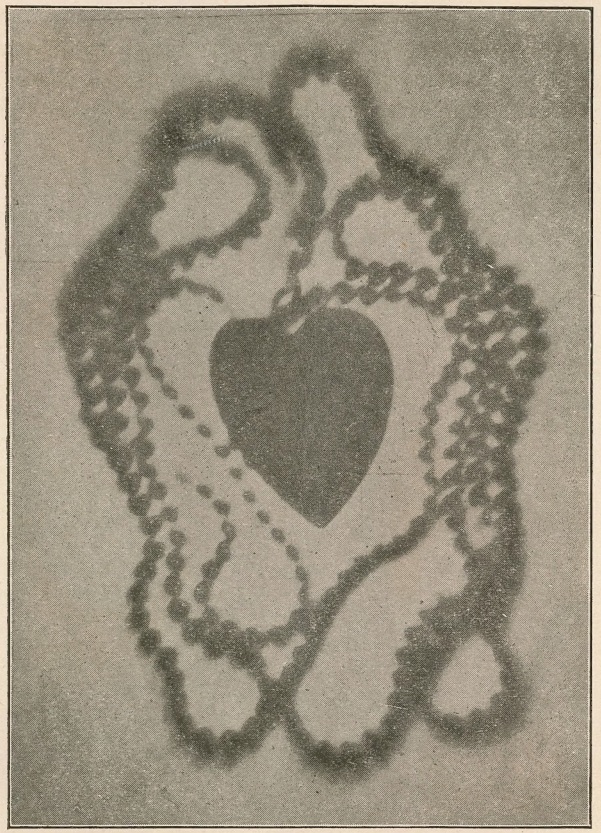

FIG. 8.

academic and abstract observations. It is the writer's belief that in no branch of the practice of medicine or surgery is expert knowledge more essential than in radiotherapy, and that a great

number of the failures to succeed must be attributed to the indiscriminate and thoughtless manner in which the treatment has been applied. Under the best management it is only too clear that a universally applicable panacea for this dread disease has not been discovered as yet, but certainly in radiotherapy there probably exists to-day a greater chance of cure in the average cases of cancer than in any other known procedure whether medical or surgical.

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